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partial beginning may be approximately computed from the following formulæ :—

$$\cos\omega = +1{\cdot}12272 - [0{\cdot}16735]\sin l + [0{\cdot}05786]\cos l\cos(\lambda - 46^\circ\ 10'{\cdot}9)$$

$$t = \text{Aug. } 8^d\ 17^h\ 38^m\ 15^s - [3{\cdot}65074]\sin\omega - [3{\cdot}65552]\sin l$$
$$- [3{\cdot}84426]\cos l\cos(\lambda - 12^\circ\ 40'{\cdot}8)$$

Contact on ⊙'s limb, $\omega - 34^\circ\ 31'{\cdot}1$ from the N. point towards the W.

and the Greenwich mean time of partial ending by—

$$\cos\omega = +1{\cdot}52241 - [0{\cdot}18107]\sin l + [0{\cdot}03061]\cos l\cos(\lambda - 14^\circ\ 21'{\cdot}7)$$

$$t = \text{Aug. } 8^d\ 17^h\ 12^m\ 18^s + [3{\cdot}57870]\sin\omega - [3{\cdot}55219]\sin l$$
$$- [3{\cdot}78268]\cos l\cos(\lambda + 19^\circ\ 13'{\cdot}1)$$

Contact on ⊙'s limb, $\omega + 31^\circ\ 48'{\cdot}0$ from the N. point towards the E.

Also the Greenwich mean times of the beginning and ending of totality may be approximately computed from the following formulæ in which the upper sign applies to the beginning, and the lower sign to the ending :—

$$\cos\omega = +70{\cdot}69521 - [1{\cdot}88965]\sin l + [1{\cdot}76504]\cos l\cos(\lambda - 29^\circ\ 43'{\cdot}0)$$

$$t = \text{Aug. } 8^d\ 17^h\ 19^m\ 17^s \mp [1{\cdot}89913]\sin\omega - [3{\cdot}61011]\sin l$$
$$- [3{\cdot}81343]\cos l\cos(\lambda + 3^\circ\ 38'{\cdot}3)$$

The quantities in square brackets are logarithms, those in the second equation of each pair being logarithms of seconds of time.

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On the Proper Motion of μ Cassiopeiæ. By W. T. Lynn, B.A.

In the upper part of the left arm of *Cassiopeia*, Bayer has marked two stars, but appears to have inadvertently omitted to letter the brighter one on his map of the constellation. But from the subsequent letterpress it is clear that he intended to indicate it by the letter θ. The fainter star in its immediate proximity he marked by the Greek letter μ. This latter star has long been well known to be endowed with a large proper motion in both elements, whilst the proper motion of θ is very small. In some future age it may perhaps be found that μ is in orbital motion round θ, and a very gigantic motion this would be. No attempt has yet been made to determine the parallax of the latter ; but the late Professor Pritchard obtained an approximate measurement of that of μ by the photographic method, the result being (value found, $0''{\cdot}04$), that its large proper motion is not due to any special proximity.

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Bessel long ago showed that this proper motion was essentially confirmed by the observations of the star made by Tycho Brahé. My present object is to deduce its accurate value, from those which have been obtained, chiefly at Greenwich, during the last fifty years. Below are tabulated the results from the Twelve-Year, Seven-Year for 1860, Nine-Year and Ten-Year Greenwich Catalogues (no observations of the star were made in the periods covered by the Six-Year and the second Seven-Year Catalogues), and the latest Radcliffe Catalogue, which is reduced to the epoch of 1890.

Catalogue.	Epoch.	R.A.	N.P.D.
		h m s	° ′ ″
12-year	1840	0 57 40·42	35 52 2·68
,,	1845	...	35 50 34·38
7-year	1860	0 58 58·93	35 46 5·77
9-year	1872	0 59 46·205	35 42 30·10
10-year	1880	1 0 17·736	35 40 8·15
Radcliffe	1890	1 0 57·167	35 37 10·15

The differences between these (omitting the observations, in one element only, of the second part of the Twelve-Year), are

	In R.A.	In N.P.D.
	m s	′ ″
20 years	+1 18·51	−5 56·91
12 years	+0 47·275	−3 35·67
8 years	+0 31·531	−2 21·95
10 years	+0 39·431	−2 58·00

From these result the annual changes—

	In R.A.	In N.P.D.
	s	″
1840–1860	+3·926	−17·846
1860–1872	+3·940	−17·972
1872–1880	+3·941	−17·744
1880–1890	+3·943	−17·800

Now the precession during the successive periods may be taken as $+3^{\mathrm{s}}{\cdot}537$, $+3^{\mathrm{s}}{\cdot}548$, $+3^{\mathrm{s}}{\cdot}554$, and $+3^{\mathrm{s}}{\cdot}560$ in R.A., and $-19''{\cdot}410$, $-19''{\cdot}388$, $-19''{\cdot}370$, and $-19''{\cdot}356$ in N.P.D. Subtracting these, we obtain for the proper motion—

	In R.A.	In N.P.D.
	s	″
1840–1860	+0·389	+1·564
1860–1872	+0·392	+1·416
1872–1880	+0·387	+1·626
1880–1890	+0·383	+1·556

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All these results are derived from a considerable number of observations, and the mean result, $+0^{s}\cdot3878$ in R.A. and $+1''\cdot540$ in N.P.D., is probably a very accurate value of the proper motion of this star. It differs slightly from that adopted in both the Greenwich Ten-Year Catalogue and the Radcliffe Catalogue for 1890, which is $+0^{s}\cdot3860$ in R.A. and $+1''\cdot580$ in N.P.D.

We will now compare the latest place, that given in the Radcliffe Catalogue, with that deduced from Bradley's observations, as given in Professor Auwers's *Neue Reduction.* The place in the latter, which is for the epoch 1755, is R.A. $0^{h}\ 52^{m}\ 9^{s}\cdot59$, and declination $+53^{\circ}\ 42'\ 35''\cdot5$ = N.P.D. $36^{\circ}\ 17'\ 24''\cdot5$. From this, by the aid of the successive precessions given by Auwers and that in the Radcliffe Catalogue (all founded on Struve's constant), we obtain for Bradley's place, reduced to 1890,

R.A. $1^{h}\ 0^{m}\ 5^{s}\cdot01$, N.P.D. $35^{\circ}\ 33'\ 38''\cdot70$.

The actual place for this date, as given in the Radcliffe Catalogue, is

R.A. $1^{h}\ 0^{m}\ 57^{s}\cdot167$, N.P.D. $35^{\circ}\ 37'\ 10''\cdot15$,

differing from the former by $+52^{s}\cdot157$ and $+3'\ 31''\cdot45$. The difference between the two epochs being 135 years, this gives for the annual proper motion $+0^{s}\cdot386$ in R.A., and $+1''\cdot566$ in N.P.D.; a result in very satisfactory agreement with that which I have deduced above from the later Greenwich and Radcliffe Catalogues.

Blackheath: 1895 *December* 9.

Description of a Spectroscope (the Bruce Spectroscope) recently constructed for use in connection with the 25-inch Refractor of the Cambridge Observatory. By H. F. Newall, M.A.

The spectroscope which is described in the present note has lately been constructed for use in connection with the 25-inch visual refractor (the Newall telescope) of the Cambridge Observatory.

It has been arranged solely for photographing spectra, and no provision has been made for visual micrometric measurements.

In designing the spectroscope, and especially in deciding on what may be described in general terms as a single-prism spectroscope, I have been guided by the following considerations. The brighter stars in the northern hemisphere have been studied in considerable detail, and provision has been made for their being further studied at many observatories. A new instrument to be used in connection with an equatorial of large light-collecting